CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A method of operating a pixel sensor cell of an image sensor comprising:

opening a mechanical shutter;

resetting a photoconversion device to begin an integration period after said shutter is opened;

accumulating photogenerated charge in said photoconversion device during said integration period;

closing said shutter to end said first integration period.

2. A method as in claim 1 wherein said act of resetting said photosensor comprises coupling said photoconversion device to a voltage source.

3. A method as in claim 2 wherein said photoconversion device is coupled to a voltage source through a reset transistor.

4. A method as in claim 3 wherein said photoconversion device is coupled to said voltage source directly by said reset transistor.

5. A method as in claim 3 wherein said photoconversion device is coupled to said voltage source through said reset transistor and a transfer transistor which transfers accumulated charge from said photoconversion device.

6. A method of operating a pixel sensor cell of an image sensor comprising:

opening a mechanical shutter;

resetting a photoconversion device after said mechanical shutter is opened to begin a first integration period;

accumulating charge in said photoconversion device during said first integration period;

resetting a charge collection region and obtaining a reset voltage;

transferring said charge from said photoconversion device to said charge collection region; and

reading out the charge residing in said charge collection region to obtain a pixel signal voltage.

7. The method of claim 6, wherein said pixel sensor cell comprises a reset transistor for resetting said charge collection region and a transfer transistor for transferring charge to said charge collection region and wherein said photoconversion device resetting comprises turning on said reset transistor and said transfer transistor.

8. The method of claim 7, wherein said reset transistor and said transfer transistor are turned on simultaneously.

9. The method of claim 7, wherein said pixel sensor cell further comprises reading out said charge through an output transistor and a row selection transistor.

10. The method of claim 9, wherein said charge is sampled by a sample/hold circuit after said readout.

11. The method of claim 6, wherein said photoconversion resetting comprises coupling said photoconversion device to a voltage source.

12. A method as in claim 11, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

13. A method as in claim 12, wherein said photoconversion device is coupled to said voltage source directly by said reset transistor.

14. A method as in claim 12, wherein said photoconversion device is coupled to said voltage source through said reset transistor and a transfer transistor which transfers accumulated charge from said photoconversion device.

15. The method of claim 6, wherein said image sensor is a CMOS image sensor.

16. The method of claim 6, wherein said charge collection region is a floating diffusion region.

17. A method of operating a pixel of an image sensor comprising:

opening a mechanical shutter;

resetting a photoconversion device after said mechanical shutter is opened to begin a first integration period;

accumulating charge in said photoconversion device during said first integration period;

resetting a charge collection region by operating a gate of a reset transistor to obtain a reset voltage;

reading out said reset voltage at said charge collection region by operating a gate of a row select transistor;

sampling said readout reset voltage;

transferring said charge from said photoconversion device to said charge collection region by operating a gate of a transfer transistor; and

reading out the charge residing in said charge collection region to obtain a pixel signal voltage; and

sampling said pixel signal voltage.

18. The method of claim 17, further comprising producing a differential signal for each pixel which comprises the difference between the sampled reset voltage and the sampled pixel signal voltage.

19. The method of claim 17, wherein said act of reading out the reset voltage comprises reading out the reset voltage from the charge collection region.

20. The method of claim 17, wherein said photoconversion device resetting comprises turning on said reset transistor and said transfer transistor before said integration period.

21. The method of claim 20, wherein said reset transistor and said transfer transistor are turned on simultaneously.

22. The method of claim 17, wherein said photoconversion resetting comprises coupling said photoconversion device to a voltage source.

23. The method of claim 22, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

24. The method of claim 23, wherein said reset transistor is part of a five transistor circuit.

25. The method of claim 24, wherein said five transistor circuit comprises at least two reset transistors, one for resetting said photoconversion device and one for resetting said charge collection region, at least one transfer transistor, at least one row select transistor and at least one source follower transistor.

26. The method of claim 25 wherein said photoconversion device is coupled to said voltage source directly by one of said at least two reset transistors.

27. The method of claim 22 wherein said photoconversion device is coupled to said voltage source through said reset transistor and a transfer transistor which transfers accumulated charge from said photoconversion device.

28. The method of claim 17, wherein said image sensor is a CMOS image sensor.

29. The method of claim 17, wherein said charge collection region is a floating diffusion region.

30. The method of claim 17, wherein said act of reading out charge further comprises reading out said charge through an output transistor and a row selection transistor.

31. A method of operating a plurality of pixels in an array of an image sensor comprising:

opening a mechanical shutter;

globally resetting the pixels to begin a first integration period;

accumulating charge in at least one photoconversion device of each pixel;

closing said shutter to end said first integration period;

resetting the pixels to obtain a respective reset voltage for each pixel and reading out said reset voltage;

transferring accumulated charge from each photoconversion device to an associated charge collection region of each pixel; and

reading out the charge residing in each charge collection region to obtain a respective signal voltage for each pixel.

32. The method of claim 31, wherein the reset and signal voltages of said pixels are readout on a row by row basis after the mechanical shutter is closed and the first integration period ends.

33. The method of claim 31, wherein said global reset is conducted by turning on a reset transistor and a transfer transistor within each pixel to couple the photoconversion device of each pixel to a voltage source.

34. The method of claim 33, wherein said reset transistor and said transfer transistor are turned on simultaneously to begin said integration period.

35. The method of claim 31, wherein said global reset is conducted by turning on a reset transistor in each pixel for resetting a photoconversion device.

36. The method of claim 31, wherein said image sensor is a CMOS image sensor.

37. The method of claim 31, wherein said charge collection region is a floating diffusion region.

38. The method of claim 37, wherein said act of reading out the reset voltage comprises reading out the reset voltage from said floating diffusion region.

39. The method of claim 31, wherein said pixel comprises four transistors.

40. The method of claim 31, wherein said pixel comprises five transistors.

41. A pixel sensor cell comprising:

a photoconversion device for accumulating charge;

a reset transistor and a transfer transistor for resetting said photoconversion device to begin an integration period;

a mechanical shutter, wherein said mechanical shutter is open during the resetting of said photoconversion device and closed to end said integration period;

a charge collection region for receiving said charge from said photoconversion device; and

a readout circuit for reading out said charge from said charge collection region.

42. The pixel sensor cell of claim 41, wherein said photoconversion device is coupled to a voltage source.

43. The pixel sensor cell of claim 42, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

44. The pixel sensor cell of claim 43, wherein said photoconversion device is coupled to said voltage source through said reset transistor

and a transfer transistor which transfers accumulated charge from said photoconversion device.

45. The pixel sensor cell of claim 41, wherein said pixel sensor cell is part of a CMOS imager.

46. The pixel sensor cell of claim 41, wherein a reset voltage is readout after said shutter is closed.

47. The pixel sensor cell of claim 46, wherein a signal voltage is readout after said reset voltage is readout.

48. The pixel sensor cell of claim 41, wherein said pixel sensor cell comprises four transistors.

49. The pixel sensor cell of claim 41, wherein said readout circuitry reads out said charge through an output transistor and a row selection transistor.

50. The pixel sensor cell of claim 49, wherein said charge is sampled by a sample/hold circuit after said readout.

51. A pixel sensor cell comprising:

a photoconversion device for accumulating charge, said photoconversion device being coupled to and reset by a reset transistor to begin an integration period;

a mechanical shutter, wherein said mechanical shutter is open during the resetting of said photoconversion device and closed to end said integration period;

a charge collection region for receiving said charge from said photoconversion device; and

a readout circuit for reading out said charge from said charge collection region.

52. The pixel sensor cell of claim 51, wherein said photoconversion device is coupled to a voltage source.

53. The pixel sensor cell of claim 52, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

54. The pixel sensor cell of claim 53, wherein said reset transistor is part of a five transistor circuit.

55. The pixel sensor cell of claim 54, wherein said five transistor circuit comprises at least two reset transistors, one for resetting said photoconversion device and one for resetting said charge collection region, at least one transfer transistor, at least one row select transistor and at least one source follower transistor.

56. The pixel sensor cell of claim 55, wherein said photoconversion device is coupled to said voltage source directly by one of said at least two reset transistors.

57. The pixel sensor cell of claim 51, wherein said readout circuitry reads out said charge through an output transistor and a row selection transistor.

58. The pixel sensor cell of claim 57, wherein said charge is sampled by a sample/hold circuit after said readout.

59. The pixel sensor cell of claim 51, wherein said pixel sensor cell is part of a CMOS imager.

60. A timing control circuit for an imager array comprising:

circuitry for applying driving voltage to at least one transistor of a pixel sensor cell of the array, wherein said transistor resets at least one photoconversion device to begin an integration period;

a mechanical shutter for ending said integration period; and

a readout circuit, wherein said readout circuit uses a rolling readout technique after said integration period ends.

61. The circuit of claim 60, wherein said pixel sensor cell further comprises a reset transistor for resetting a charge collection region and a transfer transistor for transferring charge to said charge collection region after said integration period.

62. The circuit of claim 61, wherein said reset transistor and said transfer transistor are turned on simultaneously before said integration period to reset said photoconversion device.

63. The circuit of claim 60, wherein said photoconversion device is coupled to a voltage source.

64. The circuit of claim 63, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

65. The circuit of claim 64, wherein said photoconversion device is coupled to said voltage source directly by said reset transistor.

66. The circuit of claim 64, wherein said photoconversion device is coupled to said voltage source through said reset transistor and a transfer transistor which transfers accumulated charge from said photoconversion device.

67. The circuit of claim 64, wherein said reset transistor is part of a five transistor circuit.

68. The circuit of claim 67, wherein said five transistor circuit comprises at least two reset transistors, one for resetting said photoconversion device and one for resetting said charge collection region, at least one transfer transistor, at least one row select transistor and at least one source follower transistor.

69. The circuit of claim 64, wherein said photoconversion device is coupled to said voltage source directly by one of said at least two reset transistors.

70. The circuit of claim 60, wherein said rolling readout is conducted by reading out successive rows of said imager array.

71. The circuit of claim 60, wherein said imager array is part of a CMOS imager.

72. A processor system comprising:

a processor; and

an imager coupled to said processor, said imager comprising:

a timing control circuit for globally resetting pixel sensor cells of said imager before an integration period,

a mechanical shutter for ending said integration period, and

a readout circuit, wherein said readout circuit uses a rolling readout technique after said integration period ends.

73. The system of claim 72, wherein said pixel sensor cell comprises a reset transistor for resetting said charge collection region and a

transfer transistor for transferring charge to said charge collection region after said integration period.

74. The system of claim 73, wherein said reset transistor and said transfer transistor are turned on simultaneously before said integration period to reset said photoconversion device.

75. The system of claim 72, wherein said photoconversion device is coupled to a voltage source.

76. The system of claim 75, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

77. The system of claim 76, wherein said photoconversion device is coupled to said voltage source directly by said reset transistor.

78. The system of claim 76, wherein said photoconversion device is coupled to said voltage source through said reset transistor and a transfer transistor which transfers accumulated charge from said photoconversion device.

79. The system of claim 76, wherein said reset transistor is part of a five transistor circuit.

80. The system of claim 79, wherein said five transistor circuit comprises at least two reset transistors, one for resetting said photoconversion device and one for resetting said charge collection region, at least one transfer transistor, at least one row select transistor and at least one source follower transistor.

81. The system of claim 80, wherein said photoconversion device is coupled to said voltage source directly by one of said at least two reset transistors.

82. The system of claim 72, wherein said rolling readout is conducted by reading out successive rows of said imager array.

83. The system of claim 72, wherein said imager array is part of a CMOS imager.

84. An imager device comprising:

a pixel array comprising:

a plurality of pixels;

readout circuitry for said array;

global circuitry for resetting photoconversion devices of said array to begin an integration period; and

a mechanical shutter for ending said integration period.

85. The device of claim 84, wherein said pixels are readout on a row by row basis after the mechanical shutter is closed and the first integration period ends.

86. The device of claim 84, wherein said global reset is conducted by turning on a reset transistor and a transfer transistor within each pixel to couple the photoconversion device of each pixel to a voltage source.

87. The device of claim 86, wherein said reset transistor and said transfer transistor are turned on simultaneously to begin said integration period.

88. The device of claim 84, wherein said readout circuitry comprises circuitry for reading out reset voltages and output voltages for said plurality of pixels.

89. The device of claim 84, wherein said global circuitry for resetting said photoconversion devices comprises circuitry for coupling said photoconversion device to a voltage source.

90. The device of claim 89, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

91. The device of claim 90, wherein said photoconversion device is coupled to said voltage source directly by said reset transistor.

92. The device of claim 90, wherein said photoconversion device is coupled to said voltage source through said reset transistor and a transfer transistor which transfers accumulated charge from said photoconversion device.

93. An imager integrated circuit comprising:

a doped layer formed in a substrate;

an array of pixel sensor cells formed in said doped layer, wherein said pixel sensor cells are globally reset before an integration period; and

signal processing circuitry formed in said substrate and electrically connected to the array for receiving and processing pixel signals representing an image acquired by the array and for providing output data representing said image.

94. The imager integrated circuit of claim 93, wherein said pixel sensor cell further comprises a reset transistor for resetting a charge collection region and a transfer transistor for transferring charge to said charge collection region after said integration period.

95. The imager integrated circuit of claim 94, wherein said reset transistor and said transfer transistor are turned on simultaneously before said integration period to reset said photoconversion device.

96. The imager integrated circuit of claim 94, wherein said photoconversion device is coupled to a voltage source.

97. The imager integrated circuit of claim 96, wherein said photoconversion device is coupled to a voltage source through a reset transistor.

98. The imager integrated circuit of claim 97, wherein said photoconversion device is coupled to said voltage source directly by said reset transistor.

99. The imager integrated circuit of claim 97, wherein said photoconversion device is coupled to said voltage source through said reset transistor and a transfer transistor which transfers accumulated charge from said photoconversion device.

100. The imager integrated circuit of claim 97, wherein said reset transistor is part of a five transistor circuit.

101. The imager integrated circuit of claim 100, wherein said five transistor circuit comprises at least two reset transistors, one for resetting said photoconversion device and one for resetting said charge collection region, at least one transfer transistor, at least one row select transistor and at least one source follower transistor.

102. The imager integrated circuit of claim 101, wherein said photoconversion device is coupled to said voltage source directly by one of said at least two reset transistors.

103. The imager integrated circuit of claim 93, wherein said signal circuitry further comprises readout circuitry for reading out said signals.

104. The imager integrated circuit of claim 103, wherein said readout circuitry reads out said signals using a rolling readout.

105. The imager integrated circuit of claim 93, wherein said rolling readout is conducted by reading out successive rows of said imager array.

106. The imager integrated circuit of claim 93, wherein said imager is a CMOS imager.